sPHENIX Beam Tests

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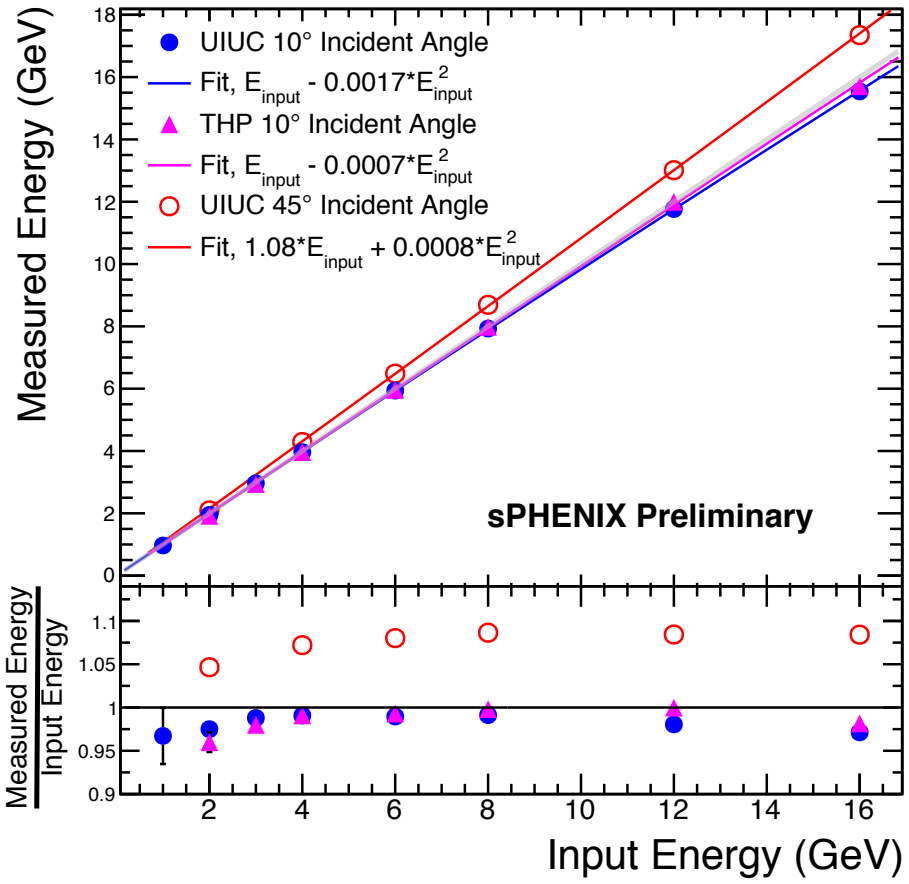
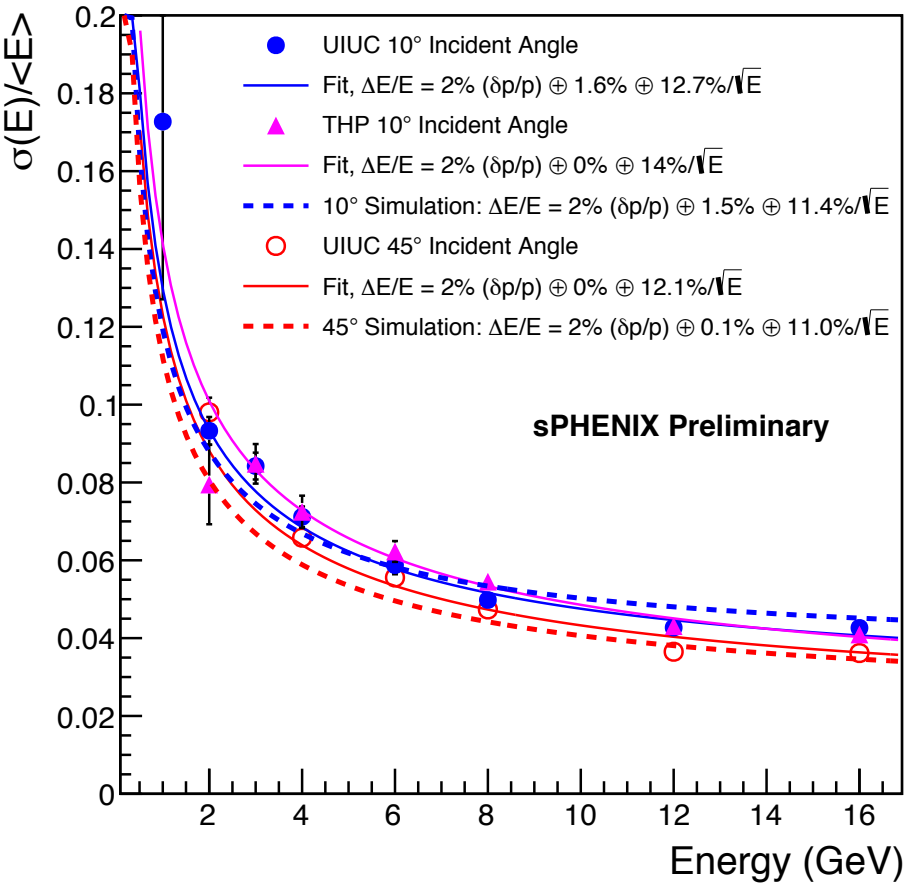
T1044-2016a

- Last year's beam test taught us a great deal about the calorimeter design around $\eta \approx 0$
- We operated the detector and beamline efficiently and accumulated a large sample of data with a wide variety of configurations
- We understood the data pretty well as we took it…
- …and thanks to the paper preparation group and leadership of Megan, Jin, Abhisek, Vera, and Ron, we are close to submitting the paper with results from the beam test

EMCAL (Figure 22)





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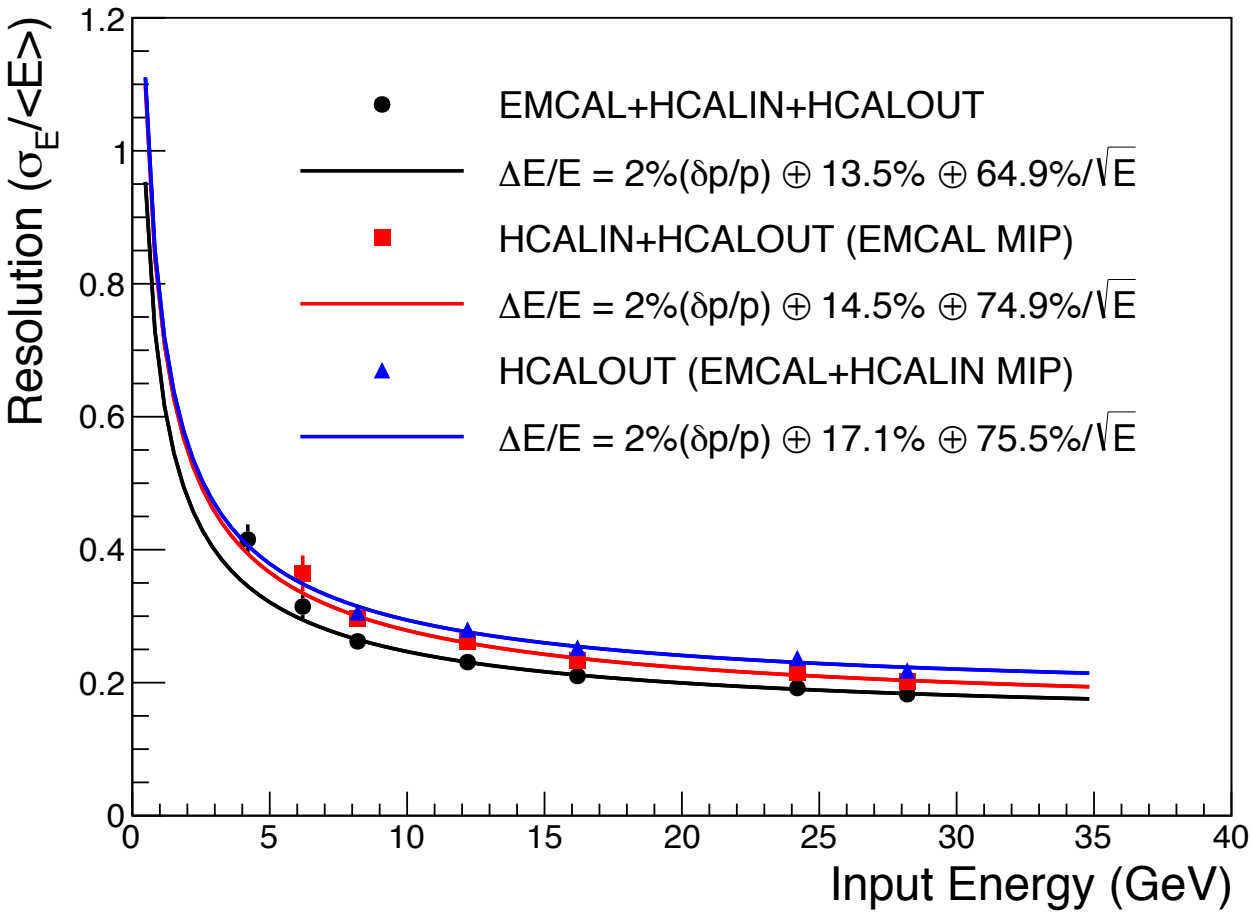
EMCAL+HCAL hadrons (Figure 31)



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On to T1044-2017a

- Ship to Fermilab Monday Jan 9 or Tuesday January 10 to arrive early enough on Thursday Jan 12 to be rigged off the truck
- Apparatus will be on beamline in MTEST on Wednesday, January 18 to prepare for operation with beam, possibly as soon as Friday, January 20
- Operations with beam January 20-February 21

No (or short) delay to startup

- There is a problem with a beamline component that may cause a short delay at the beginning of the run, but we **do not** plan to change our startup calendar
- The latest from Mandy is:

"The plan is to begin the ~2.5 day shutdown to replace the Septa on Jan. 10th. If something happens to take the machine down for a significant time before this, the Septa replacement would be done at that time if practical. AD folks are currently trying to understand better why the Septa wires have been breaking, so hopefully when the time comes we will have greater confidence in the fix. Please forward this to the impacted users, and let us know if there is anything else the Lab can do to help."

So, in theory, things should be fixed as you are coming in. I am encouraged that they are fixing it earlier. I will tell you there is still some risk. The absolute worst case is that the septum breaks again, which would put us down until April. I do believe they are serious about fixing this and keeping it going though.

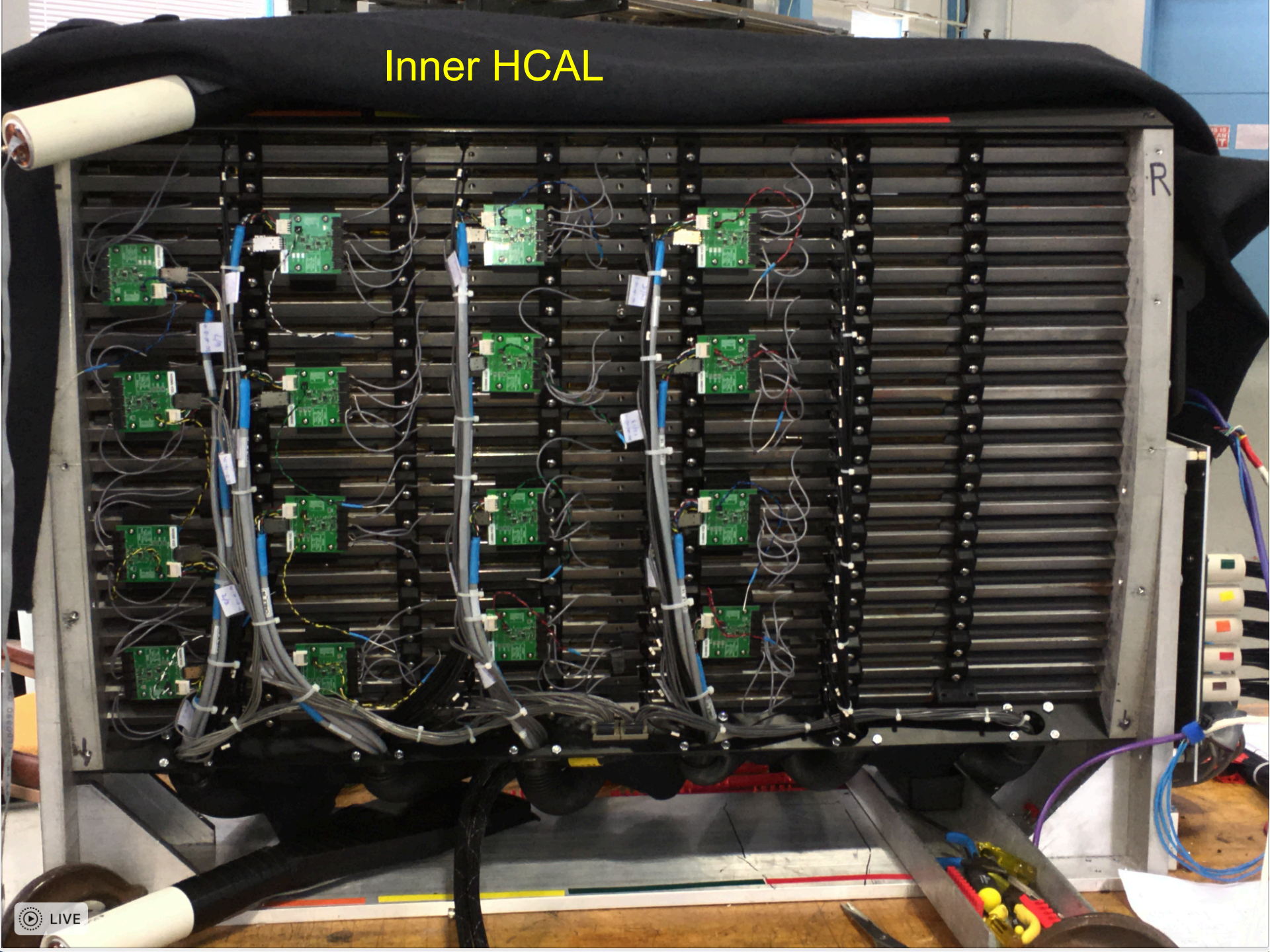
If you are interested in knowing more about how the beam is split between Meson and Neutrino lines, see
http://beamdocs.fnal.gov/AD/DocDB/0050/005040/001/magnetic-control-fermilab.pdf

Beam high level test goals

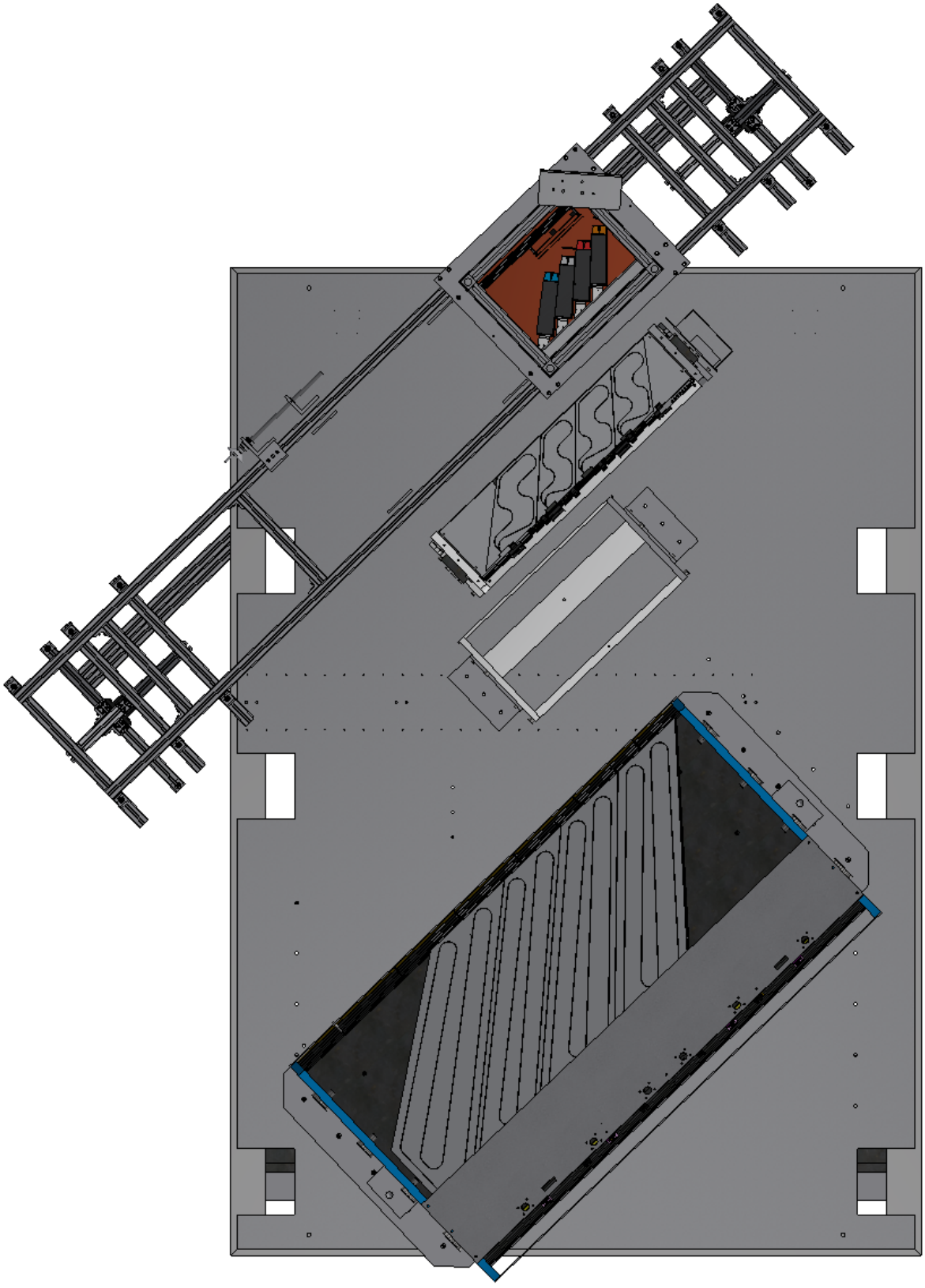
- Prove that we can make the high rapidity ($\eta \approx 0.9$) EMCAL and HCAL detectors
- Test calibration techniques for EMCAL and HCAL (cosmics/LED/ MIPs/showers)
- Compare energy resolution of electrons in EMCAL with simulation
- Compare resolution of hadrons in EMCAL+HCAL with simulation
- Confirm operation of instrumentation (preamps, digitizers, LED's)
- Write another paper

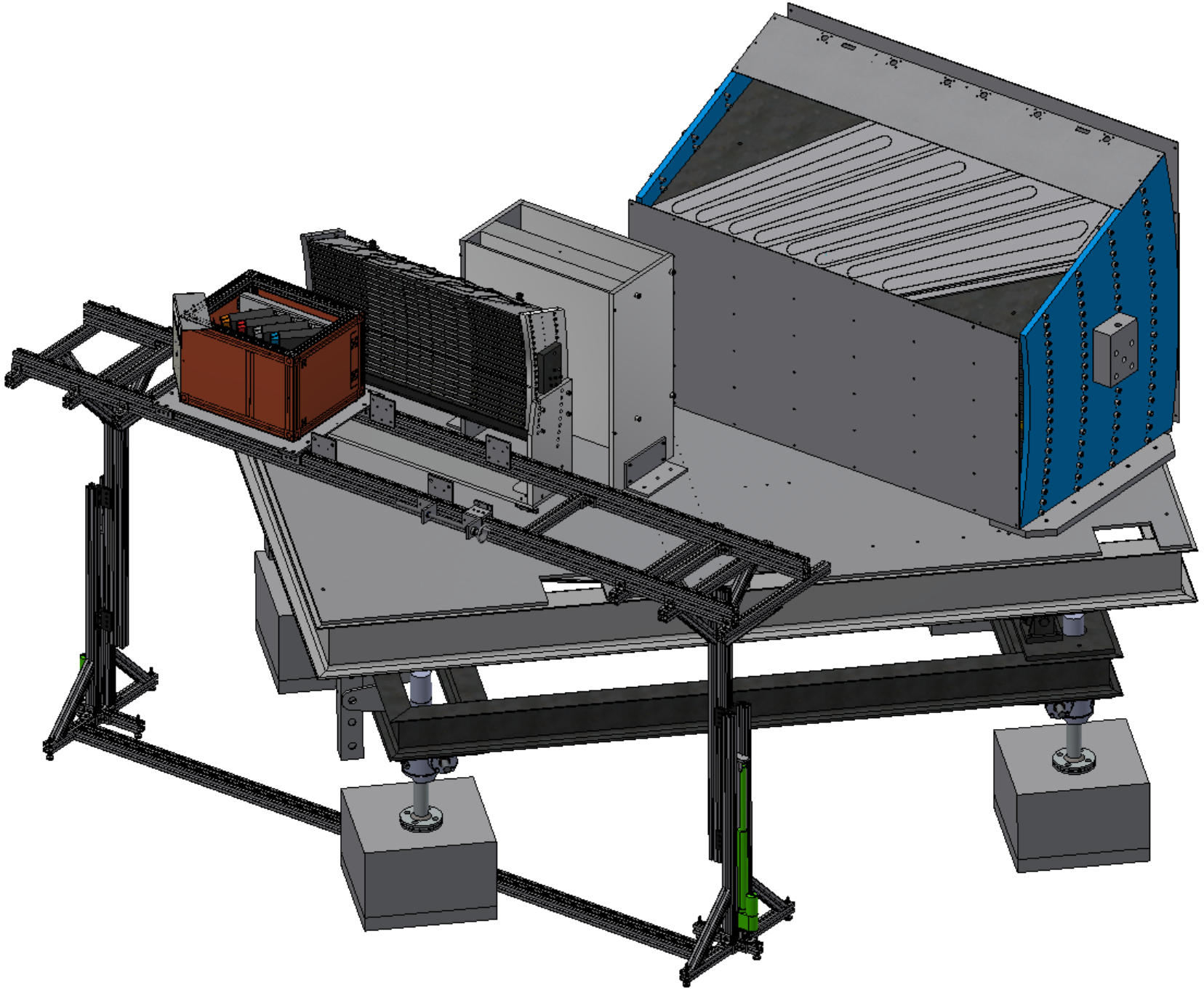
Detector readiness

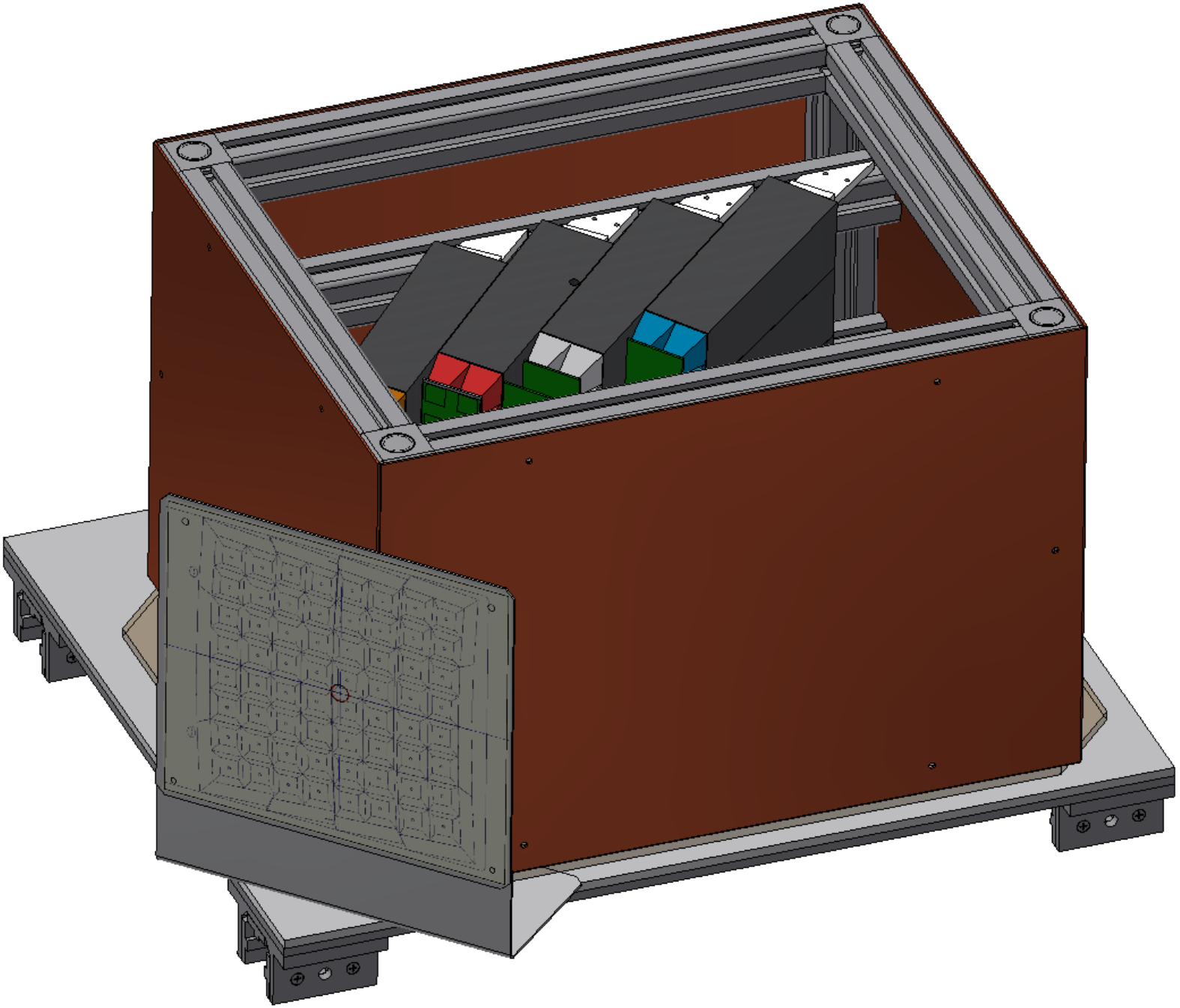
- Inner and Outer HCAL ready for beam thanks to Edward, Abhisek, Steve, Frank, Sal, Mike, Richie and others
- EMCAL is still being assembled by Craig, Anne, Sean, Bill, Steve, Sal, Richie and others; it has more new stuff:
  - Projective towers
  - New light guides
  - New electronics


Inner HCAL
R
LIVE


Outer HCAL

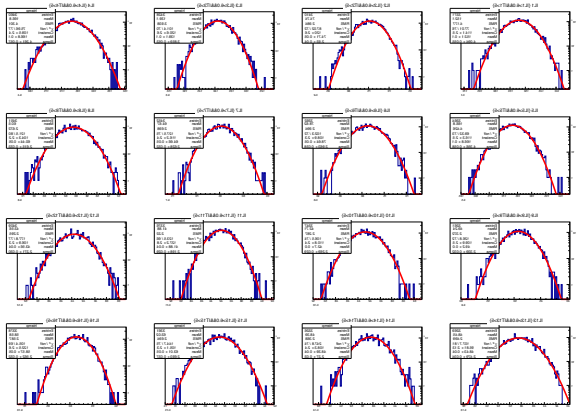




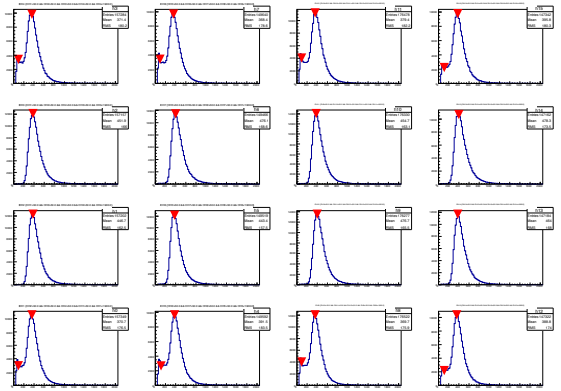


HCAL status

- Steve's new LED distribution looks good, and we can fire a tile-at-a-time
  - All tiles in all towers in IHCAL see light
- Inner HCAL done
- Done early enough so that we can do some calibration and stability studies
- Outer HCAL complete
- Edward's self-trigger looks very good in Inner and Outer
- Abhisek is running vertical cosmics to compare



IHCAL LED



OHCAL self-trigger

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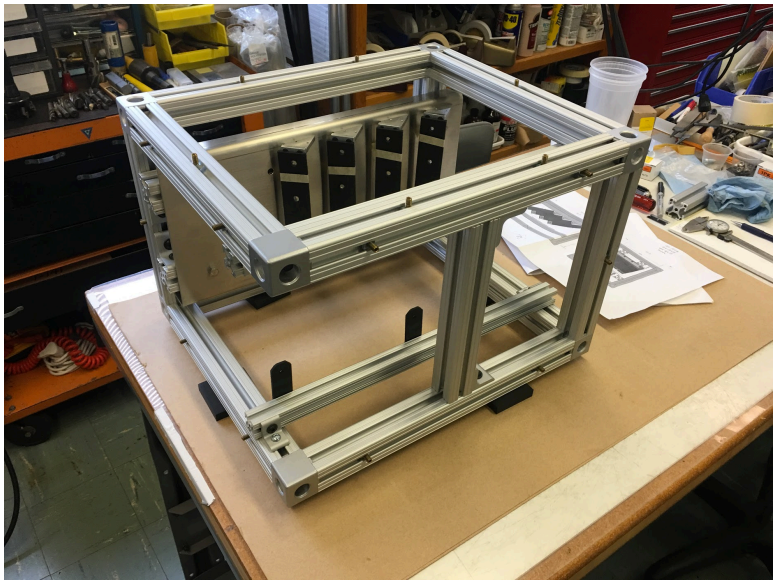

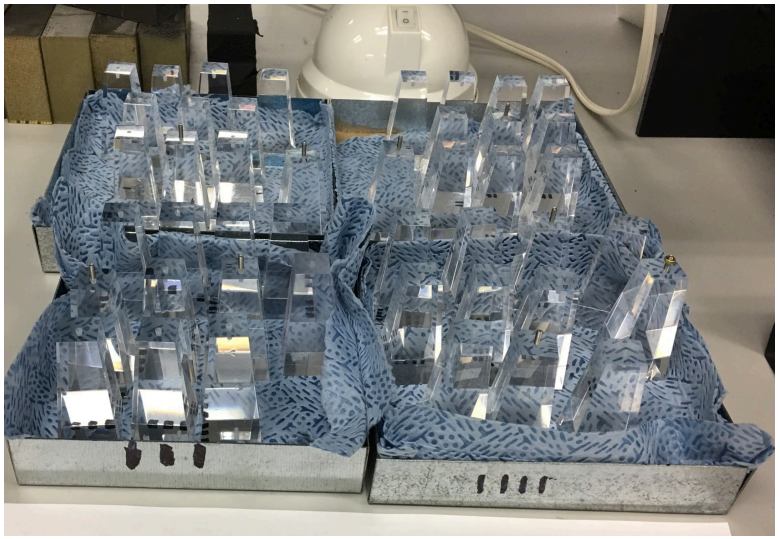

Light guides and box

UIUC EMCAL blocks

December 17, 2016

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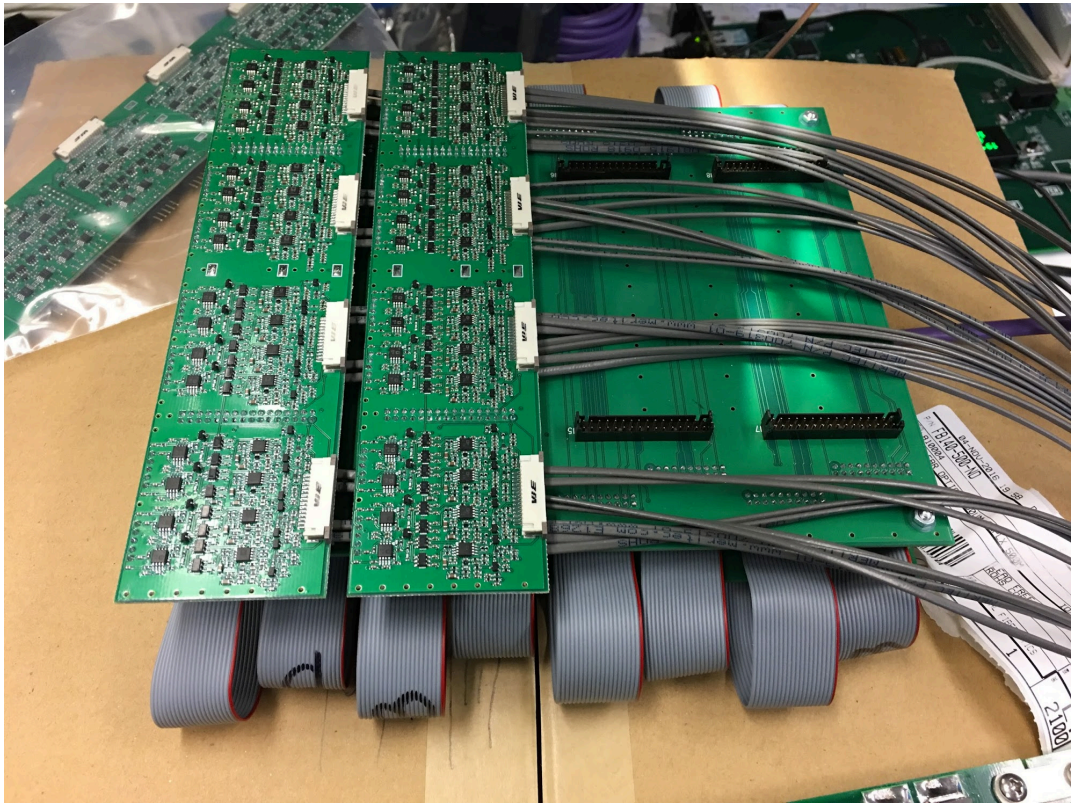
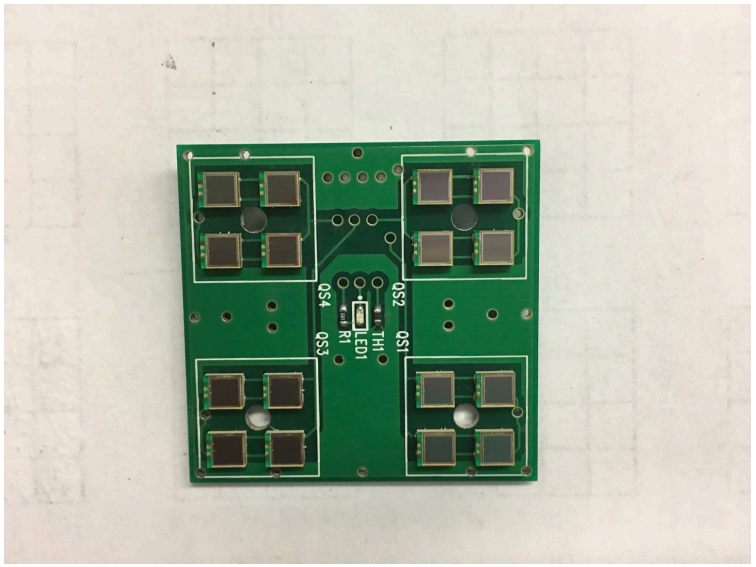


EMCAL preamp and control



EMCAL SiPM board
(4 towers, 16 SiPM's)

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Test beam travel

- We can use your help
- Talk to Eric about arrangements at Fermilab (travel, training, housing)
- Look at some data from the previous run
  - https://wiki.bnl.gov/sPHENIX/index.php/T-1044
- Let us know when you can be there
  - http://doodle.com/poll/2inumufgkdw8davz

Looking further ahead…

- I think we need a beam test of the pre-production ("first sector, or half-sector") final detector design and electronics
- May be only EMCAL and Inner HCAL
  - Instrumented half-sector of IHCAL is only 2 towers wide in Φ, 12 in η, 120 tiles
  - EMCAL is 8 towers in Φ, 48 in η, 96 blocks
- EMCAL will probably need "pre-test" several months before with small but final section of tower
  - October/November, 2017

Projected sPHENIX Schedule

CD-0	**Sept 2016**
CD-1 Practice Review – v1(sPHENIX organized)	**Feb 2017**
CD-1 Practice Review – v2(Director organized)	**April 2017**
OPA-CD-1/CD-3a Review	**Jun 2017(Target date)**
CD-1/CD-3a authorization	**Nov-Dec 2017**

Pre-production beam test March or April 2018?

All Preproduction R&D and Design complete	**May-Jun 2018**
OPA- CD-2/CD-3b review	**May-Jun 2018**
CD-2/CD-3b authorization	**Jul-Aug 2018**
sPHENIX Installed, cabled, ready to commission	**Apr 2021**
First RHIC beam for sPHENIX	**Jan 2022**

The Resource-loaded Schedule contains 8.5 months of float to Jan 2022

Other beam tests

- The calorimeters are not the only detectors that may need to see beam before collisions in 2022
- The beam tests serve as “chain tests” for the calorimeters, but the other detectors need “chain tests” and cosmics
- Probably not enough… for the MAPS and INTT perhaps we should explore using donated NSRL; are there beams available at KEK or JPARC?
- TPC test?

Detector R&D so far…

- I think the beam tests are very important for showing that we can make something other than slides
- The magnet tests, the calorimeter prototypes, the TPC field cage, the INTT ladders, and MAPS staves, and beam and chain tests of them are essential to beginning commissioning with detector components that might actually work
- Still, being prepared for 15 kHz of collisions in 2022, five years from now, is a challenge